MAIL ROOM APR 22 1991 32 PAT. & TRADEMARK OFF.

RECEIVED

APR 25 1991

GROUP 230

#3

PATENT APPLICATION
Attorney Docket No. D/90296

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope to: Commissioner of Patents and Trademarks, Washington, D. C. 20231, on April 16, 1991.

James T. Beran — 4/16/91

James T. Beran Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: Jock Mackinlay et al.
Application No.: 07/561,627 Group Art Unit: 231
Filed: August 2, 1990 Examiner:
Title: **MOVING VIEWPOINT WITH RESPECT TO A TARGET IN A THREE-DIMENSIONAL WORKSPACE**

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231
Sir:

INFORMATION DISCLOSURE STATEMENT

Applicant submits herewith information of which it is aware, which it believes may be material to the examination of this application and in respect of which there may be a duty to disclose in accordance with 37 CFR 1.56.

This Information Disclosure Statement is not intended to constitute an admission that any information referred to herein is "prior art" in relation to the claimed invention unless specifically designated as such. In accordance with 37 CFR 1.97(b), the filing of this Information Disclosure Statement shall

not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1 56(a) exists

A list of the enclosed items is set forth on the attached 3 pages of Form PTO-1449 The relevance of each listed item is set forth below.

The Fairchild et al. article is described at pages 1 and 2 of the application.

The excerpt from the Burton publication is described at page 2 of the application

The relevance of the Robertson et al. article is described at page 43 of the application.

Frasier et al EP-A 353 952, relying for priority on U.S. Patent Application No. 07 228,087 filed August 4, 1988, describes reduced viewport techniques for a graphics display system The operator can observe manipulations of video image planes that are wholly or partially outside a viewing area. A two-dimensional input image plane is transformed to a three-dimensional image plane due to manipulation, such as rotation or translation As shown and described in relation to Fig. 2, during direct transfer of transformation parameters, changes can be made by the operator using a joystick or keypad, and run information for interpolating between keyframes provides orientation of two keyframes and an inbetweening coefficient, used by an inbetween algorithm to compute a new set of transformation parameters. A user controlled reduction coefficient is applied to a reduced viewport algorithm to produce reduced viewport points and mapping function, having the effect of mapping all the points closer to the center of the graphics display As shown and described in relation to Fig. 3, 3 D

transformation data is input to a 3-D mapping algorithm to produce a 3-D center of rotation and a 3-D mapping function. The actual manipulation of 2-D image planes in three dimensions is shown and described in relation to Fig. 5, including the application of a reduced viewport coefficient R to the mapping function to subject subsequent mappings to the same scaling. Figs. 6 and 7 show examples of output.

The Herot et al. article describes Spatial Data Management System (SDMS) in which data is accessed via pictorial representations which are arranged in space and viewed through a computer graphics system. The user can create and examine data surfaces which are larger than the display screen, traversing a surface and zooming in and out to control the level of detail displayed. Section 2.1 describes the graphical display space, and section 2.3 describes motion in the graphical data space through joy stick control. Pressing the joy stick in any direction causes the user's magnified window to move in that direction at a speed proportional to the pressure exerted. Twisting the joy stick causes the picture to enlarge in two stages: The first stage is done by zooming the display, a hardware technique which causes pixels to be replicated on the display, as shown in Fig. 8. The second stage depends on the user's position on the data surface, and may activate a port or lead to a more detailed version of the data surface, as shown in Figs. 10-12.

The Badler et al. article describes multi-dimensional input techniques using a 6 degree-of-freedom sensor based on a low frequency magnetic field and a wand which interacts with the field. Page 154 notes that it is usually necessary to position the viewer and the direction the viewer is gazing, indicating that absolute motioning worked better than relative motioning in

this case. Page 155 indicates that, by using the wand as a camera, the experimenters were quickly able to focus in on defects and determine their extent by simply pointing the wand at a region in question from the desired view direction.

The Brooks article describes a tool allowing prototyping of buildings by visually walking through them by using continuous real-time production of TV-cartoon-quality shaded, colored, stereo views. Section 0.3 describes the Ikonas walkthrough, in which the user gets a floorplan view on the vector display, with eye position and direction marked by a cursor and a rendered view on the Ikonas display. Section 0.4 describes the Pixel-Planes walkthrough in which the user interface was converted from a vector display, a character display, a data tablet, and a box of analog knobs and sliders to a workstation system using only a mouse and screen. Section 0.5 describes the big-screen walkthrough, using a Polhemus sensor rigged to give six degrees of freedom.

The Ware et al. article evaluates metaphors for exploration and virtual camera control in virtual environments using a six degree of freedom input device. Page 175 observes that the task of placing a viewpoint in a virtual 3D environment has inherently six degrees of freedom, three for positional placement and three for angular placement. An additional degree of freedom can provide a field of view scale factor, equivalent to zoom. Pages 177-178 describe three metaphors. The eyeball in hand metaphor is described in relation to Fig. 1, the scene in hand metaphor in relation to Fig. 2, and the flying vehicle control in relation to Fig. 3. As described on page 178, spatial velocity and angular velocity are controlled directly because people can control velocity more easily than acceleration; a non-linear

control on translational velocities makes the velocity related to the cube of the displacement. Experimental results are described beginning at page 180; the flying vehicle control metaphor does not allow the user to move directly from one viewpoint to another as in the eyball in hand metaphor, but rather the user can set the velocity and must then wait until the viewpoint flies to the desired position. Subjects found it difficult to fly around an object while maintaining it in the line of sight, the best technique for which combined lateral and angular velocities resulting in an orbit. Flying vehicle control allows the user to ease-in and ease-out the camera positions at very slow speeds.

The excerpt from the Bier report describes a technique for positioning a camera for precise eyepoint movement. During a completion phase, the camera is moved so that selected objects appear as they did at the end of an interaction phase. Gravity is active during these transformations so that the camera can be moved by precise distances and angles.

The Haeberli article describes ConMan, a visual programming language for interactive graphics. The second paragraph on page 8 describes how a low-pass filter component can be placed between a view editor and another component to filter view transformations over time, illustrated in Fig. 9. With this technique, a sudden step translation results in the geometric model moving along an exponential curve towards the new position in time, giving the model a feeling of mass.

The Dalton article describes CloseView, a feature available on the Apple Macintosh, which is a subset of Berkeley System Design's InLarge program.

InLarge adds horizontal and vertical image stretching and selective magnification of a portion of the screen.

The Berkeley Systems in Large brochure describes inLarge in more detail. This document is not dated, but applicant stipulates that the features described were publicly known as of the date of the Dalton article. As noted on the second page, inLarge usually fills the whole screen with a magnified view, but the user can define a smaller magnification window, perhaps just enough for one line at a time, and the unmagnified background can be blanked out to reduce distraction. A scanning feature automatically moves the magnified view across the screen at a set rate.

The page from the <u>IRIX User's Reference Manual</u> describes mag, a program that copies and enlarges areas of the screen. The area copied is chosen by the user with the mouse, and the power of magnification is an integer entered into the command line.

The excerpt from the <u>Graphics Library Programming Guide</u> describes window, a projection transformation that shows the world in perspective. As illustrated in Fig. 7-3, its viewing frustum is defined in terms of distances to the left, right, bottom, top, and near and far clipping planes. The excerpt also describes orthogonal transformations that correspond to the limiting case of a perspective frustum as the eye moves infinitely far away and the field of view decreases appropriately.

The Woods article describes visual momentum. Page 238 describes a spatial access technique in which a data base is organized as a topology and the viewer has a mechanism to move through the space, by discrete moves through fixed frames or by analog mechanisms allowing the viewer to scan a

large display plane. For this to be effective, the user must be able to anticipate subsequent views, such as with a high resolution viewing area surrounded by a lower resolution, wide field-of-view area analogous to the structure of the visual system. Data access improves when the function of travelling over the data landscape is kept distinct from the function of examining a neighborhood in more detail.

The Hochberg et al. article describes visual momentum in the context of film cutting, describing at page 294 how filmmakers provide sequences of nonoverlapping views such as montages, or rhythmic series of discontinuous shots, relying on the viewer's knowledge of the world or on establishing shots such as long shots to provide the glue that joins the successive views. In other words, the filmmaker changes camera position, even when it is not necessary to tell the story, to keep the screen alive to the viewer.

The excerpt from the Glassner book describes computer-assisted animation. Page 181 describes in-betweening in relation to Figs. 14-7 and 14-8. Pages 184-187 discuss the use of a computer to do in-betweening for two-dimensional animation in relation to Figs. 14-10 through 14-13, including interpolation techniques. Pages 187-193 discuss three-dimensional animation in relation to Figs. 14-14 through 14-16, including in-betweening and interpolation.

The excerpt from the Foley et al. book also describes animation, describing conventional inbetweening at pages 1058-1059. Page 1059, including footnote 3, describe zooming in which a portion of an image is enlarged to fill the screen. Pages 1060-1064 describe interpolation. Pages 1077-1078

describe basic rules of animation, including slow-in and slow-out to help smooth interpolations, including camera position.

The Examiner's attention is also drawn to applicant's related Application Nos. 07/030,766; 07/241,525; 07/488,587; 07/562,048 and the claims and information submitted in relation thereto.

Applicant requests that the Examiner consider the items set forth above and make them of record in this application.

Respectfully Submitted,

James T. Beran

James T. Beran
Attorney For Applicant
Registration No. 31,090
Phone: (415) 494-4253

Palo Alto, California
April 16, 1991